Soil and Soil Water Properties

Soil stores water that is used to maintain plant growth between rainfall and/or irrigation events. The amount of water stored by the soil is influenced by soil texture, organic matter content and the depth of soil. The ability to extract water from the soil. Water is held as a film around each soil particle, in micro pores between particles and is absorbed by organic matter (much like a sponge).

1. Soil Water Holding Capacity (or Available Water)

This term describes the soil's ability to store water, usually expressed as mm of water/ depth of soil or % (by volume). The water holding capacity is the amount of water stored in the soil between field capacity and wilting point.

Soils consisting of large particles (i.e. stones, gravel and sand) have low water holding capacities. These soils have a greater proportion of large (macro) pores, fewer soil particles per volume of soil and therefore low particle surface area.

Soils made up of small particles (silt and clay) have much lower proportion of macro pores than micro pores, have greater number of particles per volume of soil, have greater particle surface area and therefore capable of storing more water.

Rule of Thumb - the finer the soil texture, the higher the water holding capacity

2. Field Capacity (or Full Point)

The total amount of water stored in the soil held by tension against gravity. Typically it is the amount of water stored in the soil once drainage resulting from gravity ceases following a large rainfall event. Soil particles are wet and micro pores contain water. The macro pores have drained and are filled with air.

3. Permanent Wilting Point

The moisture stored in the soil when the water is held too tightly for plants to extract. This usually occurs at approx 1500cba and if water is not added to the soil plants will die.

4. Readily Available Water

For each and very crop there is a proportion of the water holding capacity or available water that can be easily extracted. Not all the available water can be extracted fast enough by plants to transpire at the potential rate required to maintain optimum or potential growth.

5. Stress Point (Refill Point)

The soil moisture content in the crop root zone when the readily available water has been depleted. Maintaining the moisture content above the stress point ensures the plant water demand is met and there is no growth limitations attributed to water availability.

If the soil moisture content in the crop root zone falls below the stress point the plant's transpiration requirement exceeds the rate of supply from the soil. Plants will react to the limited supply of moisture by:

- closing stomata (a slow process and not visible to the naked eye);
- reducing photosynthesis (growth slows and leaf colour may change);
- reducing cell division (potential fruit or grain size is reduced); and
- reducing cell expansion (final fruit or grain diameter or weight is reduced).

Crop yield and quality will be lost and cannot be recovered.

Every plant species has a greater or lesser ability to extract water, e.g. on the same soil type, pasture will reach stress point before a grapevine because grapes are able to extract more of the soil moisture than pasture to maintain optimum growth.

6. Stress Point to Wilting Point

If the soil moisture content falls below the stress point there is not enough water in the soil to maintain optimum growth during the day. Initially there is enough moisture stored in the soil for the plant to partially recover over night. Plant life is sustained below the stress point, but growth patterns are disrupted. As the soil moisture content falls further toward the permanent wilting point the plant will experience longer and longer periods of wilt. These periods will eventually include the night hours, at which point the plant will be severely damaged and die (wilting point is reached).

The properties described above are crucial for making objective irrigation management decisions. On-site soil moisture monitoring can determine and provide:

i. **full point -** how can you start if you don't know the maximum amount of water your soil can hold;
ii. **readily available water** - how can you calculate the next irrigation or the amount to apply if you don't know the amount available to the plant;
iii. **stress point** - how do you know when your crop will come under stress if a stress point hasn't been determined for your crop on your soil;
iv. **crop root depth** - how can you calculate the depth of soil and amount of water if your don't know the depth of the root zone;
v. **depth profile of soil moisture** - how can you tell you've applied too much water if you can't measure moisture content below the root zone; and
vi. **crop specific scheduling advice** - to achieve the best possible yield some crops benefit from varying moisture levels throughout the growing season.

HydroServices has for 25 years specialised in providing the best determination of the 'must haves' when it comes to irrigation management.

On-site, accurate irrigation management to meet your specific requirements